

Physics Division Future Plans

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Director's Annual Review

November 8-9, 2005

Summary of Progress



- Important technical progress on SNAP R&D, particularly in the sensor area-visible & IR detectors meet or exceed SNAP specifications
- Supernova Factory taking data this year
- ATLAS silicon-strip tracker undergoing installation
- ATLAS pixel tracker in production
- Run II CDF physics hitting full steam
- BaBar physics at full steam
- CMB work breaking new ground in instrumentation; PolarBear proposal in preparation
- θ_{13} neutrino effort showing promise – we await NUSAG recommendations
- Theory: EWSB, CKM, extra dimensions, particle astrophysics, strings...

Exciting activity at every turn

Our highest scientific priorities in the longer term are:

- 1. Electroweak Symmetry Breaking
(LHC, ILC)**
- 2. Dark Energy in the Universe
(SN/SNAP, CMB)**
- 3. A modest neutrino program, joint with NSD
featuring KamLAND and a reactor-based θ_{13}
measurement**

Active Proposals

Initiatives: New Experiments



- We are developing new proposals for science
 - POLARBEAR
 - Reactor Experiment to Measure θ_{13}
 - International Linear Collider (ILC) R&D
- We cannot accommodate those proposals within our current budget
- We are working with the university community to build strong collaborations
- Development supported by LDRD

- **Motivation**
 - Detect the B-mode polarization of the CMB, a signal of gravity waves from Inflation
- **Proposal**
 - To be submitted in Winter 2005
- **Weiss Panel report supports work in this area**

Reactor Experiment to Measure θ_{13}



- **Motivation:**
 - A precision experiment to measure the mixing angle θ_{13}
- **Proposal:**
 - In preparation. Documents submitted to NUSAG in Summer 2005

- **Science Validation:**

The importance of a θ_{13} measurement has been evaluated by a number of committees and review panels and is also evident in the number of publications on this topic. A precision reactor neutrino measurement to measure θ_{13} is included as a near-term priority in the preliminary recommendations of the APS Neutrino Study that were discussed at Snowmass in July 2004:

“A comprehensive program to attack the coupled problem of the θ_{13} , mass hierarchy and CP violating phase δ should include a reactor experiment with a sensitivity of 0.01 for $\sin^2 2\theta_{13}$ and a long-baseline accelerator experiment sensitive to the hierarchy through matter enhancement.”

International Linear Collider



- **We expect to play a significant role in ILC R&D as international program ramps up**
- **Battaglia has established an R&D program for ILC supported by LDRD**
- **Kolomensky active on beam instrumentation**
- **Ronan making major contributions to detector R&D, especially TPC**
- **With the technology decision in hand and support from the LDRD, our effort will grow**
- **AFRD concentrating on damping ring design**

Near Term Issues

Near term science for LBNL:

**Dark Energy studies – High- z SN Measurements,
Supernova Factory
APEX/SZ**

Flavor Physics – BaBar, CDF, KamLAND

Standard Model and Beyond – CDF, then ATLAS

In Development:

**ATLAS upgrade, JDEM/SNAP, CMB Polarization
(Polar Bear), θ_{13} , ILC**

**Near term priorities: Keep developments on schedule,
harvest physics from past investments.**

Actions to Accommodate Budget



- **Allocated resources to high priorities in accordance with strategic plan and review recommendations:**
 - **CDF, D0 and BaBar into ATLAS and Dark Energy**
- **Accelerate reduction in postdocs for lower priority efforts and bring in needed staff for high priorities**
- **Reduce non-labor allocations for all programs, especially lower priorities**
- **Reduced JDEM/SNAP engineering**

FY05 Program Impacts



- **Severe reductions of travel & purchases**
- **Reduction in Force to trim labor, both scientific staff and support staff**
- **Continue planned net manpower reductions (CDF, BaBar)**
- **Delay engineering work on CMB, neutrinos**
- **Delay planned ATLAS manpower increases**
- **Support new initiatives through LBNL LDRD (neutrinos, ILC)**

A very tough year.

Budget Information (\$K)



	FY04 Actual	FY05 Allocation	FY06 President's
LBNL Physics Research	21419	19165	18293
ATLAS Project	3694	2434	2020
JDEM/SNAP R&D	2498	2950	2900
Total Funding	27611	24549	23213

FY06 President's Budget



Protons EQU	\$3,800	ATLAS
Protons OPS	\$1,600	CDF and Neutrinos
Electrons OPS	\$1,200	BaBar and ILC R&D
Non-Accelerator EQU	\$950	Mostly SNAP
Non-Accelerator OPS	\$2,493	SCP, SNFactory, CMB Theory
Theory/PDG OPS	\$3,550	Theory Group and PDG
Technology EQU	\$1,850	SNAP
Technology OPS	\$2,850	SNAP + CMB detectors (~\$500K)
Total	\$18,293	

FY06 Project Budget



ATLAS Project EQU	\$205	ATLAS Project (expect + ~\$1.5M)
ATLAS Project OPS	\$1,815	ATLAS Computing
SNAP OPS	\$2,000	
SNAP EQU	\$900	
OHEP Computing	\$370	Detailer in Germantown
Total Project	\$5,290	

Longer Term Plans



Longer term science for LBNL:

What is Dark Energy? - Hi Z surveys

What are the origins of mass? - ATLAS

What powers inflation? - PolarBear

Is CP violation observable in the neutrino sector? - θ_{13}

In Development:

SNAP, ILC, CMB polarization satellite, ...?

Problem Areas



- **Prepare for ATLAS physics, support ATLAS University community**
- **Enhance Cosmology Theory**
- **Maintain Dark Energy Science Program**
- **Strengthen Neutrino projects**
- **Support linear collider R&D**
- **Wealth of data on CDF and BaBAR but group strength draining fast**

Budgetary Outlook



- **Our long-standing priorities do not fit within a flat-flat scenario for the next several years**
- **In order to understand how to respond if FY07(or FY06!) budget news is bad, we plan a two-day retreat in early December**
- **Purpose is to reach consensus on a new set of priorities for the program – how do we balance depth vs breadth**
- **Also to explore how we keep technical capabilities alive for current and future use by the University community**

Draft Retreat Agenda



Day 1

- **8:00 Continental Breakfast**
- **8:30 Introduction**
Discussion, including how to capture information gathered from these presentations and discussions
- **10:00 ATLAS Opportunities and Plans**
- **10:45 Break**
- **11:00 Discussion**
- **12:00 SNAP/JDEM scenarios**
- **12:45 Lunch**
- **1:15 Dark Energy Science Opportunities and Plans**
- **1:45 Discussion**
- **2:45 CMB Opportunities and Plans**
- **3:15 Discussion**
- **4:15 Wine and cheese to end the day**

Day 2

- **8:00 Continental Breakfast**
- **8:30 Neutrinos Opportunities and Plans**
- **9:15 Discussion**
- **10:15 ILC Opportunities and Plans**
- **10:45 Break**
- **11:00 Discussion**
- **12:00 Lunch**
- **1:00 Foster New Ideas**
 - Underground Lab
 - Direct Dark Matter Detector
 - Others
- **1:45 Discussion**
- **2:30 Discussion of Funding Opportunities to Consider**
- **3:00 Break**
- **3:30 Are there others? Discussion**
- **4:00 Wrap up and next steps**

Outline of opportunities & plans content



- **Ongoing priorities currently and current opportunities for larger impact**
- **What must be dropped in various scenarios**
- **Possible impact of new/expanded efforts**
- **Minimum needs**
- **Impact on core capabilities**
 - **Instrumentation**
 - **Computing**
 - **Physics analysis**

Areas for Advice



- Advise Steve Chu on the quality and impact of our work
- Advise us how to improve making our science case to the community
 - we are seeking support from our collaborations & building broader user support
 - ongoing physics at LBNL squeezed dramatically...
- How do we make the case to the lab for further investment in the Division in the post-SNAP LDRD era?
 - Neutrinos
 - Astrophysics development, theory and experiment
 - New instrumentation for future experiments and other fields
- How do we make a better enterprise with the support we have now?
- What opportunities are we missing? What are we “not seeing”?

Quality of Our Program Remains Very High



Statements of support –

•R. Staffin from February 2004 DOE Review

•*“LBNL is the best in the world in:*

•*Dark Energy*

•*Semiconductor detectors (both particle and light detectors)*

•*High-field magnets [AFRD]*

•*Particle data group, education and outreach*

•*LBNL is as good as the best in the world in:*

•*Collider physics analysis and computing”*

•R. Staffin from May 2003 DOE Review

—“The overall evaluation is that LBNL is performing outstanding work with a strong emphasis on many of the important areas of high energy physics. The DOE HEP budget continues to be quite tight, and we recognize that has a significant impact on LBNL program. I want to work with you to find ways of continuing LBNL’s excellence in these challenging times.”

Summary



- ☐ **LBNL has helped shape HEP in the US over the past decade.**
- ☐ **We have established and continue a record of innovation and achievement.**
- ☐ **We are positioned to have a major impact on ATLAS and Dark Energy Science and are exploring smaller projects with great science potential**